



**JOINT BASE CHARLESTON-AIR
ENVIRONMENTAL RESTORATION PROGRAM
NORTH CHARLESTON, SOUTH CAROLINA**



**STATEMENT OF BASIS FOR LONG-TERM GROUNDWATER MONITORING WITH
LAND USE CONTROLS**

**SOLID WASTE MANAGEMENT UNIT 67 (LF017)
LANDFILL AREA NO. 2**

STATEMENT OF BASIS

**Joint Base Charleston-Air
North Charleston, South Carolina**

Facility/Unit Type: Joint Base Charleston-Air (JBCA)/Solid Waste Management Unit (SWMU) 67 (LF017) Landfill Area No. 2

Contaminants: Pesticides

Media: Groundwater and Surface Water

Proposed Remedy: Long-Term Monitoring (LTM) with Land Use Controls (LUCs)

INTRODUCTION

This Statement of Basis (SoB) proposes LTM with LUCs as the final remedy decision for SWMU 67 (LF017, also referred to as the site). It also provides background information for the site, explains the rationale for proposing LTM with LUCs as the final remedy, and invites the public to comment on this proposal. The South Carolina Department of Health and Environmental Control (DHEC) will not finalize this decision until the public comment period has ended and all information submitted during the public comment period has been reviewed and considered.

JBCA (also referred to as the Base) is located in Charleston County, approximately 10 miles northwest of Charleston, South Carolina (see **Figure 1**). JBCA comprises 3,731 acres of contiguous property with a Base population of approximately 8,500.

Air Force Environmental Restoration Program (ERP) Site SWMU 67 (LF017) – Landfill Area No. 2 is included in the JBCA Resource Conservation and Recovery Act (RCRA) Permit #SC3 570 024 460, dated October 4, 2010 (Permit). The Permit, issued by DHEC, lists SWMU 67 as requiring a RCRA Facility Investigation (RFI).

SWMU 67 was historically used as a landfill from 1956 until 1985 receiving an estimated 70,000 cubic yards of general refuse and, due to practices widely accepted at that time, potentially received minor amounts of industrial wastes such as paints, solvents, and batteries. Landfilled materials remain in place and pesticides have been detected in groundwater at concentrations exceeding their screening criteria. Periodic groundwater and surface water sampling is conducted to monitor pesticide concentrations in groundwater and to monitor for any degradation of groundwater quality due to waste left in place and/or groundwater impacts to surface water.

This SoB should not be considered the primary source of site information. Documents providing greater site detail are located in the administrative record maintained at JBCA and the DHEC office located in Columbia, South Carolina (addresses provided at the conclusion of this document). DHEC encourages the public to review these documents to gain a more thorough understanding of the site and the activities that have been conducted. A list of key site-specific documents used to prepare this SoB follows:

- Installation Restoration Program Phase I – Records Search (Preliminary Assessment), Charleston Air Force Base, South Carolina, Engineering Science, October 1983. This site was identified as potentially containing hazardous contaminants resulting from past Base activities.

- Revised Draft Installation Restoration Program Phase II – Stage 1 Confirmation/Quantification, Charleston Air Force Base, South Carolina, Science Application International Corporation (SAIC), April 1988.
- Installation Restoration Program – Stage 2, Draft Remedial Investigation/Feasibility Study Report, Charleston Air Force Base, South Carolina, Versar, October 1991.
- Installation Restoration Program (IRP) Documents to Support No Further Response Action Planned (NFRAP) for Charleston Air Force Base, South Carolina, Halliburton NUS Corporation, August 1994.
- Draft/Final Phase II RCRA Facility Investigation and 2014 Groundwater Monitoring Report, SWMU 67 – LF017 – Landfill Area No. 2, Joint Base Charleston-Air, North Charleston, South Carolina, URS Group, Inc. (URS), June 2015.
- Final Focused Corrective Measures Study and Annual Groundwater Monitoring Report, SWMU 66 – LF004 – Landfill Area No. 1 and SWMU 67 – LF017 – Landfill Area No. 2, March 2017.

PROPOSED REMEDY DECISION

The proposed remedy decision for SWMU 67, LTM with LUCs, was selected through a Focused Corrective Measures Study (CMS), which identified 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'-dichlorodiphenyldichloroethylene (4,4'-DDE), and dieldrin in groundwater as chemicals of concern (COCs) at SWMU 67. A Focused CMS is normally performed when the scope of a remedy is very narrow or a presumptive remedy is being evaluated. A presumptive remedy, LTM with LUCs, is being evaluated for SWMU 67. Because of limited data and waste left in place, LTM will involve sampling groundwater from nine monitoring wells and analyzing the samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and Target Analyte List (TAL) metals in addition to pesticides. In addition, surface water will be collected from Golf Course Creek and analyzed for pesticides because, conceivably, contaminated groundwater could migrate from SWMU 67 and discharge into Golf Course Creek. The Focused CMS also developed the corrective action objective of continuing to protect human health and the environment by eliminating or minimizing the potential for exposure to COCs in groundwater at concentrations greater than their respective human health screening levels (HHSs). The DHEC Bureau of Land and Waste Management, Division of Waste Management, RCRA Federal Facilities Section concurred with the remedy decision in a letter dated May 18, 2017 (DHEC, 2017).

There is no direct citation in the DHEC regulations stipulating that periodic monitoring be conducted for a landfill site with waste left in place even if there are no identified COCs, such as with surface water in Golf Course Creek. The monitoring requirement is implied by the DHEC Pollution Control Act (South Carolina Law, Title 48, Chapter 1), South Carolina Hazardous Waste Management Regulations (R.61-79), JBCA RCRA Part B Permit, United States Environmental Protection Agency's (USEPA's) Presumptive Remedy for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Landfill Sites (Directive No. 9355.0-49FS), and USEPA's Application of the CERCLA Municipal Landfill Presumptive Remedy to Military Landfills (Directive No. 9355.0-67FS).

SITE DESCRIPTION

SWMU 67, also known as LF017, Landfill Area No. 2, is located on the western side of JBCA, within the Base golf course. Golf Course Creek, which is located along the southern site boundary, acts as an hydrologic boundary separating SWMU 67 from former landfill SWMU 66, also referred to as LF004. A portion of Golf Course Creek is concrete-lined, and flow within the stream is toward the west. The former landfill was capped with an earthen cover and currently features a groomed vegetative cover (Engineering Science, 1983). **Figure 2** presents the site area, the approximate boundary of the former landfill, and the LUC boundary.

Although SWMU 67 is not currently the subject of an LTM program, groundwater monitoring was conducted semi-annually during the Phase II RFI (URS, 2015) and Focused CMS (URS, 2017a) and is proposed on an annual basis going forward. LTM, consisting of groundwater and surface water sampling, with LUCs, is proposed as the final remedy. Site monitoring wells are sampled and analyzed for VOCs, SVOCs, pesticides, and metals; surface water samples are collected and analyzed for pesticides. LUCs have not been officially implemented at SWMU 67; however, annual inspections are conducted to assess the integrity of the soil and grass cover.

PREVIOUS INVESTIGATIONS

IRP Phases I and II

SWMU 67 was originally identified during a records search performed in 1983 by Engineering Science. This was followed by a field investigation in 1985 that included installing and sampling five perimeter groundwater monitoring wells, as well as sampling and analyzing sediment and surface water. Iron was detected in groundwater above its secondary maximum contaminant level (MCL), which is an aesthetic, not health-based, criteria. Several metals and VOCs were detected in sediment and surface water; however, none were detected at concentrations posing a threat to human health or the environment (SAIC, 1988). In 1990, a second phase of IRP investigation activity was performed that included installing one well and sampling it along with one existing well. Total petroleum hydrocarbons and VOCs were not detected in either of the wells (Versar, 1991).

Phase I RFI and IRP Documents to Support NFRAP

Phase I RFI and IRP Documents to Support NFRAP: In 1992, one well, 67-MW14-06, was sampled and analyzed for VOCs, base/neutrals and acids, pesticides/polychlorinated biphenyls, metals, and total petroleum hydrocarbons. Various metals were detected but none exceeded screening criteria. In 1994, a Phase I RFI was conducted at SWMU 67 and reported in a 1994 IRP compendium document to support NFRAP at numerous sites. The report documented field activities and summarized previous investigations. The RFI field activities included aquifer testing and collecting soil, groundwater, surface water, and sediment samples. Samples were analyzed for VOCs, SVOCs, metals, pesticides, and polychlorinated biphenyls. Key findings of the Phase I RFI were documented in the aforementioned IRP NFRAP support document and are listed below:

- Metals detected in groundwater samples collected from monitoring wells 67-MW14-01, 67-MW14-02, and 67-MW14-06 (67-MW14-03, 67-MW14-04, and 67-MW14-05 were abandoned in 1990) were all reported at concentrations below their HHSLs. Acetone, the only VOC detected, was reported at a concentration below its MCL and pesticides were not detected.
- Various VOCs, pesticides, and metals were detected in soil borings 67-SB01 and 67-SB02 (see **Figure 2**). Pesticides and VOCs were detected in soil at concentrations below applicable standards. Only one metal, beryllium, was identified as a potential COC.
- VOCs, SVOCs, pesticides, and metals were detected in surface water sample 131-SW17 and sediment sample 131-SD17, respectively (see **Figure 2**). Only pesticides and metals were detected above applicable standards in both the surface water and sediment samples. However, these sampling locations were hydraulically upgradient from SWMU 67.

Data generated during the Phase I RFI were used to evaluate current baseline risk at the site and it was concluded that the site did not present unacceptable risk under current and foreseeable future uses. As a result of the RFI, SWMU 67 was recommended for no further action (NFA). The IRP Documents to Support NFRAP was based on the quantitative risk assessment which indicated that no adverse effects were anticipated based on current or future land use scenarios (Halliburton NUS Corporation, 1994). DHEC requested additional risk information to support the NFA recommendation for SWMU 67 in a letter dated July 9, 1998. No additional field activities were conducted at SWMU 67 until the 2014 Phase II RFI, discussed below.

Phase II RFI

In 2014, a Phase II RFI was performed to resolve data gaps at SWMU 67, where the site had not been sampled since 1994 and the existing monitoring network did not extend around the entire landfill perimeter. Activities included installing five additional groundwater monitoring wells: 67-MW14-07, 67-MW14-08, 67-MW14-09, 67-MW14-10, and 67-MW14-11. Following installation, the five new wells and three existing wells (67-MW14-01, 67-MW14-02, and 67-MW14-06) were sampled in July and November 2014 and the samples were analyzed for VOCs, SVOCs, pesticides, and metals. Analytical results for the samples collected at well 67-MW14-07 indicated that 4,4'-DDD, reported at an estimated concentration of 9.5 µg/L, exceeded its HHSL of 0.23 micrograms per liter (µg/L) in July and dieldrin, reported at a concentration of 1.4 µg/L, exceeded its HHSL of 0.0018 µg/L in November. Results indicated that pesticide contamination appeared to be generally localized to the immediate area that is hydraulically downgradient from the former landfill. During the November sampling event, one metal, cadmium, with a reported concentration of 22.2 µg/L in the sample from well 67-MW14-01, exceeded its Base background

concentration of 6 µg/L (DHEC, May 15, 2000). However, well 67-MW14-01 is located hydraulically upgradient of SWMU 67 and it does not appear that SWMU 67 represents a potential source of cadmium to this well.

A qualitative evaluation of the data with respect to the original 1994 human health risk assessment (HHRA) (Halliburton NUS Corporation, 1994) was performed re-confirming the conclusions of the original risk assessment that SWMU 67 does not pose an unacceptable risk to potential receptors under current land use. A screening level ecological risk assessment was not performed. However, exposure pathways from groundwater (the focus of this investigation) to ecological receptors were considered incomplete. Phase II RFI Report recommendations included installing DHEC-requested downgradient monitoring well 67-MW14-12 for inclusion in the LTM network and combining co-located SWMUs 66 and 67 into the Focused CMS to evaluate potential measures that could serve to accelerate site closure of the two SWMUs and reduce life-cycle costs. It was anticipated that the Focused CMS would compare the No Action alternative to continuing the current LTM program. Following approval of the Focused CMS, a SoB would be developed for SWMU 67 and the Permit amended with the recommended final remedy (URS, 2015).

In a letter dated June 26, 2015, DHEC concurred with the recommendation to perform a Focused CMS that combined co-located SWMUs 66 and 67 and also installing downgradient monitoring well 67-MW14-12 for inclusion in the LTM network (DHEC, 2015).

Focused CMS

A Focused CMS was prepared for SWMU 67 evaluating presumptive remedial alternatives that protect human health and the environment, support preparing a SoB, and support implementing a final remedy. The alternatives evaluated included No Action and LTM with LUCs and resulted in LTM with LUCs being selected as the proposed remedy. The Draft/Final Focused CMS for SWMUs 66 and 67, which included the 2015 groundwater monitoring results for SWMU 67, was submitted to DHEC in April 2016. The 2015 groundwater monitoring event included installing DHEC-requested downgradient well 67-MW14-12 in June 2015. Following installation, the new well and eight existing wells were sampled and analyzed for VOCs, SVOCs, metals, and pesticides. Groundwater analytical results for the sample collected at well 67-MW14-07 indicated 4,4'-DDD at a concentration of 6.7 µg/L and 4,4'-DDE at a concentration of 0.12 µg/L, both exceeding their HHSLs of 0.032 µg/L and 0.046 µg/L, respectively. Results also indicated that 4,4'-DDD at a concentration of 0.092 µg/L in the sample from well 67-MW14-12 exceeded its HHSL of 0.032 µg/L. DHEC responded in a letter dated July 29, 2016, requesting that surface water and sediment monitoring be added to the proposed remedial action for SWMU 67. With 4,4'-DDD exceeding its HHSL in downgradient well 67-MW14-12, DHEC was concerned that contaminated groundwater from SWMU 67 could be discharging into Golf Course Creek.

DHEC clarified in an email dated September 8, 2016 that sediment sampling would be required only if surface water analytical results indicated impacts from SWMU 67. Surface water sampling was conducted in February 2017. Analytical results from upgradient location 67-SW1 and downgradient location 67-SW2 (see **Figure 2**) reported estimated concentrations of dieldrin at both the upgradient (0.0064 µg/L) and downgradient (0.0047 µg/L) sampling locations in Golf Course Creek, both below its screening criteria of 0.056 µg/L (USEPA, 2015). Based on the results, pesticides associated with SWMU 67 were not impacting surface water in Golf Course Creek (URS, 2017b). Revisions were incorporated into the document and the Final Focused CMS (URS, 2017a) and Surface Water Sampling Analytical Results for Solid Waste Management Unit (SWMU) 67 (LF017), Joint Base Charleston-Air, South Carolina Technical Memorandum (URS, 2017b) were submitted to DHEC on March 22, 2017. In a letter dated May 18, 2017, DHEC approved the Final Focused CMS for SWMUs 66 and 67, with LTM (groundwater and surface water) with LUCs as the proposed remedy for SWMU 67 (DHEC, 2017).

Periodic Monitoring

SWMU 67 is not currently the subject of an LTM program. Prior to 2014, groundwater sampling was conducted during 1985, 1990, 1992, and 1994. Recent groundwater sampling events were conducted during July and November 2014, and summer 2015. Surface water sampling was conducted during February 2017. An evaluation of pre-2014 groundwater analytical results identified no contaminant concentrations exceeding screening criteria. Groundwater COCs identified during 2014 and 2015 consisted of three pesticides: 4,4'-DDD, 4,4'-DDE, and dieldrin (URS, 2017a). No pesticides exceeded screening criteria in the 2017 surface water samples (URS, 2017b). Periodic groundwater and surface water monitoring will continue to evaluate if COCs are migrating, and either decreasing or increasing over time.

SUMMARY OF SITE RISKS

Based on the findings presented in the Phase II RFI Report (URS, 2015) and Final Focused CMS (URS 2017a), maximum detected concentrations for all metals in groundwater except cadmium are below Base background levels. For titanium, neither Base background levels nor HHSLs were identified. Thus, titanium represents an uncertainty and no qualitative or quantitative assessment of potential human health risk from exposure can be made. Cadmium is the only metal

that exceeded its HHSL during the November 2014 sampling event. The HHSL for cadmium is based on an MCL of 5 µg/L. The corresponding USEPA regional screening level (RSL) for tapwater is 9.2 µg/L, corresponding to a hazard quotient of 1. The single exceedance occurred in well 67-MW14-01, with a measured cadmium concentration of 22.2 µg/L. This well is located hydraulically upgradient of SWMU 67 (see **Figure 2**). As a result, it does not appear that SWMU 67 represents a potential source of cadmium to this well.

For the organic constituents, the maximum detection of 4,4'-DDD (9.5 µg/L) exceeded its HHSL (0.032 µg/L) in well 67-MW14-07 during July 2014. Dieldrin was detected in well 67-MW14-07 during November 2014 (1.4 µg/L) at a concentration exceeding its HHSL (0.0018 µg/L). During June 2015, 4,4'-DDE exceeded its HHSL (0.046 µg/L) in well 67-MW14-07 with a concentration of 0.12 µg/L.

The USEPA RSL (USEPA, 2016) for 4,4'-DDD in tapwater is 0.032 µg/L, which represents a concentration equal to a cancer risk of 1E-06. Assuming an exposure concentration of 9.5 µg/L¹, and proportioning this concentration to the tapwater RSL, results in a potential cancer risk of 3E-04 for a residential scenario. The RSL for dieldrin in tapwater is 0.0018 µg/L, which represents a concentration equal to a cancer risk of 1E-06. Assuming an exposure concentration of 1.4 µg/L, and proportioning this concentration to the tapwater RSL, results in a potential cancer risk of 8E-04 for a residential scenario. Dieldrin also has a noncancer tapwater RSL of 0.38 µg/L, which is equivalent to a hazard quotient of 1. Assuming an exposure concentration of 1.4 µg/L, and proportioning this concentration to the tapwater noncancer RSL, results in a potential noncancer hazard quotient of 3.7. The RSL for 4,4'-DDE in tapwater is 0.046 µg/L, which represents a concentration equal to a cancer risk of 1E-06. Assuming an exposure concentration of 0.12 µg/L, and proportioning this concentration to the tapwater RSL, results in a potential cancer risk of 3E-06 for a residential scenario.

Discussions for 4,4'-DDD, dieldrin, and 4,4'-DDE are based on the maximum detected concentrations. Examination of multiple data over time may result in substantially lower projected risks and hazards. (For example, dieldrin and 4,4'-DDE were only detected during November 2014 and June 2015, respectively, and 4,4'-DDD was not detected during November 2014.)

It is also of note that several of the constituents detected represent volatile chemicals relevant to potential vapor intrusion considerations. Among the USEPA-defined volatile chemicals (USEPA, 2012) detected in groundwater, these include toluene, trichloroethylene, and mercury. Although the vapor intrusion pathway is considered incomplete, the maximum concentration of each chemical is below the groundwater screening values for vapor intrusion presented in USEPA vapor intrusion guidance (USEPA, 2002):

Constituent	Maximum Concentration Detected (µg/L)	Groundwater Vapor Intrusion Screening Value (µg/L)
Toluene	0.5	1,500
Trichloroethylene	0.33	5
Mercury	0.16	0.68

Screening values based on Risk = 1E-06 or Hazard Index = 1

The recent groundwater data confirm that vapor intrusion is not a significant concern at SWMU 67.

COCs identified in groundwater at SWMU 67 during the July and November 2014 and June/July 2015 sampling events are 4,4'-DDD, dieldrin, and 4,4'-DDE, which occurred primarily in well 67-MW14-07. Although cadmium was found to exceed its respective HHSL, the only exceedance occurred in an upgradient monitoring well (67-MW14-01). Groundwater at SWMU 67 is currently not used as a drinking water source, nor is it projected to be used as a drinking water source in the foreseeable future. The indoor vapor intrusion pathway was also considered incomplete as no buildings are currently present, nor

¹ This is based on the maximum detected concentration. There are insufficient data to calculate a conservative estimate of the mean concentration (such as the 95% Upper Confidence Limit).

are structures anticipated to be built at SWMU 67 in the future: nonetheless, concentrations of chemicals potentially relevant to the vapor intrusion pathway are below screening levels.

There is no significant impact to human health at SWMU 67 because groundwater at SWMU 67 is not used, nor is it projected to be used, as a drinking water source in the foreseeable future, thereby representing an incomplete exposure pathway (Note: Per DHEC Regulation R.61-68.H, all South Carolina groundwater is classified Class GB and is considered to be a potential source of drinking water). However, because of hypothetical risk levels of 3E-04 for 4,4'-DDD, 8E-04 for dieldrin, and 3E-06 for 4,4'-DDE for a future resident ingesting groundwater, the site is not applicable for unrestricted use.

A screening level ecological risk assessment was not conducted for SWMU 67. SWMU 67 is located on the western side of JBCA, within the Base golf course. Potential exposure pathways from groundwater (the focus of this investigation) to ecological receptors are considered incomplete.

DESCRIPTION OF ALTERNATIVES

The Final Focused CMS identified 4,4'-DDD, 4,4'-DDE, and dieldrin as groundwater COCs for SWMU 67 (URS, 2017a). To address the presence of pesticides in groundwater, the following actions were evaluated in the Final Focused CMS (URS, 2017a):

- Alternative 1 - No Action
- Alternative 2 – LTM with LUCs

Detailed information for each alternative evaluated is provided in the Final Focused CMS and Annual Groundwater Monitoring Report for SWMU 66 – LF004 – Landfill Area No. 1 and SWMU 67 – LF017 – Landfill Area No. 2 (URS, 2017a) and summarized below.

Alternative 1 – No Action

The No Action alternative provides a basis for comparing existing site conditions with those resulting from the implementation of the other alternatives considered.

Effectiveness

This alternative results in no additional risk reduction at the site. Under the No Action alternative, constituent concentrations may change over time, but under a No Action alternative this would not be confirmed or evaluated because monitoring would not be performed. The change in concentrations is not monitored or documented, making it impossible to determine when remediation goals have been met or whether site conditions have changed. The presence of waste left in place makes this alternative ineffective.

Implementability

This alternative is technically and administratively implementable as no engineering or administrative procedures are required. No capital expenditures or operation and maintenance costs are associated with the No Action alternative.

Alternative 2 – LTM with LUCs

LUCs refer to a broad range of either institutional or engineering controls of the property. LUCs can include institutional controls such as governmental controls, proprietary controls, informational devices, or active land or construction management by the property owner. LUCs can include engineering controls such as site controls and land maintenance. The Base Remedial Project Manager (RPM) works with the 628 Civil Engineer Squadron Base Community Planner (Base Community Planner) to confirm that LUCs are implemented and enforced at applicable sites.

Active land or construction management controls include the specification of protocols for projects planned to occur within the boundaries of a site while under control of the property owner. At the Base, the RPM will review any project plans that may disturb the selected area evaluated. This review will take place prior to proceeding with any new construction or maintenance activity. The review is initiated when the JBCA Civil Engineer Squadron processes a dig permit where the RPM is one of the required approvers. If land disturbing activities impact an ERP site, the RPM will contact DHEC for notification as specified in the Permit. The RPM will also review plans for projects located at a site to determine if additional protections are needed for construction workers or the surrounding environment. In addition,

the development and implementation of a health and safety program may be required for activities taking place at a site.

Engineering controls include barriers, such as the existing fence, to prevent access to a site. Vegetative control devices may be used as an alternative barrier to a specific media of concern, such as the use of an existing grass cover to limit exposure and/or transport of soils.

LTM activities may include the inspection of in-place control devices at a site or periodic sentinel groundwater monitoring to confirm the assumptions of the risk assessment (i.e., no change in current land use and groundwater is not used as a drinking water source) and the resulting conceptual site model (CSM) are still intact.

Effectiveness

LUCs prevent exposure to the site by limiting the ability of people to gain access to the site, thus minimizing or preventing contact with COCs. LUCs do not directly provide on-site restoration, but could reduce the potential for human exposure by preventing land use that could result in exposure to impacted soil and/or groundwater. Because JBCA is an actively managed facility with environmental management, LUCs such as construction permitting reviews, identification of potentially impacted areas, and periodic inspections by JBCA personnel can be very effective at minimizing or eliminating personnel contact with impacted areas of the installation. LUCs presented in the DHEC-approved CMS (URS, 2017a), such as a vegetative cover, and groundwater monitoring are currently in place and have proven to be effective for both JBCA personnel and the general public.

Implementability

LUCs are either already in place or planned at the site as follows:

- Vegetative cover
- Land use restrictions (i.e., no residential, commercial, or industrial development and no use of groundwater) through the Base Community Planner
- Construction management review and planning, including construction permitting reviews, dig permits, and identification of impacted areas by logging the area boundaries into the Base geographic information system
- Environmental management reviews, including annual landfill cover inspections and maintenance activities

EVALUATION OF ALTERNATIVES AND SELECTION OF THE PROPOSED REMEDY

A summary of the evaluation for the above-referenced alternative scenarios, including estimated costs, are presented on **Table 1**.

The proposed selected Final Remedy at the site is implementing a LTM program very similar to what is already performed at the site. The specific program includes LTM with LUCs:

- LUC No. 1: Logging the LUC boundaries (inclusive of all polygon coordinates) and use restrictions into the Base geographic information system to officially identify the site as being impacted and to prompt RPM reviews of any proposed disturbance or new use of the site. The review is initiated when the JBCA Civil Engineer Squadron processes a dig permit where the RPM is one of the required approvers. If land disturbing activities impact an ERP site, the RPM will contact DHEC for notification as specified in the Permit.
- LUC No. 2: Continuing annual landfill cover/cap inspections and maintenance of necessary items such as erosion and removal of nuisance trees. Identified exposed debris will also be covered with soil contained within the areal extent of SWMU 67. General surface conditions will be restored such that it promotes good drainage, including the cover soil source area.
- Performing groundwater monitoring at the DHEC-required frequency, which is currently on a semi-annual basis, with a proposed annual frequency going forward upon DHEC approval. The current sampling network consists of wells 67-MW14-01, 67-MW14-02, 67-MW14-06, 67-MW14-07, 67-MW14-08, 67-MW14-09, 67-MW14-10, 67-MW14-11, and 67-MW14-12. The groundwater monitoring wells will be analyzed for USEPA Contract Laboratory Program (CLP) Target Compound List (TCL) VOCs, USEPA CLP TCL SVOCs, USEPA CLP TCL pesticides, and TAL metals, currently including aluminum, antimony, arsenic, barium, chromium, cobalt, copper, iron,

lead, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, strontium, thallium, tin, titanium, vanadium, and zinc. The purpose of the sentinel monitoring is to provide assurance that potential additional releases from the landfill not identified during the RFI do not adversely affect the CSM and expose potential receptors to unacceptable risks. However, even if additional releases occur, the LUCs being imposed as part of this remedy will be protective of human health and the environment. Periodic groundwater analytical results will be evaluated using screening criteria in place at the time of each sampling event to assess remedy effectiveness. A Corrective Measures Implementation (CMI) Work Plan will be developed to articulate the exact monitoring schedule. CMI Progress Reports (i.e., LTM Reports) will recommend future reductions, including removal of a particular analytic suite, etc., for DHEC approval. The recommendations will be based on the collection of sufficient data over time to justify the reductions.

- Performing periodic surface water monitoring for SWMU 67, with a proposed annual frequency going forward upon DHEC approval. Two surface water samples will be collected from Golf Course Creek and analyzed for TCL pesticides. An upgradient/background sample (67-SW1) will be collected east of Arthur Drive and a downgradient sample (67-SW2) will be collected south of 67-MW14-12 (see **Figure 2**). The purpose of the surface water sampling is to provide verification that contaminated groundwater from SWMU 67 is not discharging into Golf Course Creek. Sediment sampling is not warranted unless surface water analytical results indicate impacts from SWMU 67. The CMI Work Plan discussed in the above bullet will be developed to also include the surface water monitoring schedule.
- At a minimum, a yearly report will be submitted summarizing the field events that took place at the site during that year. In some cases it will be an inspection letter/report. In other cases it will also include the reporting of groundwater and surface water samples collected and analyzed. The report will also discuss if there has been a Change in Land Use during the reporting period.
- The selected remedy will be re-evaluated in a Revised CMI Work Plan if the selected remedy is judged to be ineffective, such as new COCs are identified that pose an additional risk to human health and/or the environment.

STATUTORY AUTHORITY

This document is being issued pursuant to Section 44-56-10 et seq. Regulation 61-79 of the 1976 South Carolina Code of Laws, as amended. The JBCA Corrective Action Program is conducted under the authority of Sections 3004 (u), 3004 (v), 3005(c)(3), 3008(h), 3013, 6001, and 7703 of RCRA (42 United States Code 6901 et seq.) as amended by the Hazardous and Solid Waste Amendment of 1984 (Pub. L. No. 98-616, 98 Stat. 3221) and the Federal Compliance Act of 1992 (Pub. L. J02-386, J06 Stat. 1505). This SoB is part of the corrective action process and is a requirement of RCRA Part B Permit # SC8 170 022 620, issued to JBCA by DHEC.

REFERENCES

- Engineering Science, 1983. Installation Restoration Program Phase I - Records Search (Preliminary Assessment), Charleston Air Force Base, South Carolina, October 1983.
- Halliburton NUS Corporation, 1994. Installation Restoration Program Documents to Support No Further Response Action Planned, Charleston Air Force Base, South Carolina, August 1994.
- Science Applications International Corporation, 1988. Revised Draft Installation Restoration Program Phase II – Stage 1 Confirmation/Quantification, Charleston Air Force Base, South Carolina, April 1988.
- South Carolina Department of Health and Environmental Control, 2000. Base Wide Background Study Letter from David Scaturo to Al Urrutia dated May 15, 2000.
- South Carolina Department of Health and Environmental Control, 2015. Approval Letter from DHEC to JBCA for the Draft/Final Phase II RFI Report dated June 26, 2015.
- South Carolina Department of Health and Environmental Control, 2017. Approval Letter from DHEC to JBCA for the Final Focused CMS dated May 18, 2017.

- URS Group, Inc., 2015. Draft/Final Phase II RCRA Facility Investigation Report, SWMU 67 – LF017 – Landfill Area No. 2, Joint Base Charleston-Air, North Charleston, South Carolina, June 2015.
- URS Group, Inc., 2017a. Final Focused Corrective Measure Study and Annual Groundwater Monitoring Report, SWMU 66 – LF004 – Landfill Area No. 1 and SWMU 67 – LF017 – Landfill Area No. 2, Joint Base Charleston-Air, North Charleston, South Carolina, March 2017.
- URS Group, Inc., 2017b. Surface Water Sampling Analytical Results for Solid Waste Management Unit (SWMU) 67 (LF017), Joint Base Charleston-Air, South Carolina Technical Memorandum, March 22, 2017.
- USEPA, 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). EPA 530-D-02-004.
- USEPA, 2012. Superfund Vapor Intrusion FAQs.
http://www.epa.gov/superfund/sites/npl/Vapor_Intrusion_FAQs_Feb2012.pdf.
- USEPA, 2015. Region 4 Freshwater Surface Water Screening Values for Hazardous Waste Sites.
- USEPA, 2016. Regional Screening Level Master Table. May.
- Versar, 1991. Draft Installation Restoration Program – Stage 2, Remedial Investigation/Feasibility Study Report, Charleston Air Force Base, South Carolina, October 1991.

FIGURES

TABLE